CLAIMS

1. HIV-1 group (or subgroup) O retroviral protein, or natural or synthetic peptide or polypeptide comprising at least a part of said protein, which is capable of being recognized by antibodies which may be isolated from serum obtained after an infection with an HIV-1 group O VAU strain, or an HIV-1 group (or subgroup) O DUR strain.

2. Protein, polypeptide or peptide according to claim 1, characterized in that it may be obtained by expression, in a host cell, of a nucleotide sequence, more particularly DNA and cloned DNA fragments which may be obtained from RNA, from cDNA or from primers which may be used for gene amplification, derived from RNA or from DNA of the HIV-1 group (or subgroup) O retrovirus, said nucleotide sequence being characterized in that it comprises the sequence corresponding to Seq ID No. 5 as well as any portion of that sequence or variant of that portion which is capable of hybridizing with the corresponding DNA or RNA of the HIV-1 group (or subgroup) O virus, and in that said protein comprises the amino acid sequence between residues 1 and 526 of Seq ID No. 6 as well as any peptide, polypeptide, glycoprotein or variant derived from said sequence having an epitope which may be recognized by antibodies induced by the HIV-$1_{(VAU)}$ virus.

3. Protein, polypeptide or peptide according to claim 1 or 2, characterized in that it may be obtained by expression, in a host cell, of a nucleotide sequence according to claim 1, and in that said protein comprises the amino acid sequence between residues 527 to 877 of Seq ID No. 7 as well as any peptide, polypeptide, glycoprotein or variant derived from said

sequence having an epitope which may be recognized by antibodies induced by the HIV-$1_{(VAU)}$ virus.

4. Peptide or polypeptide according to claim 1 to 3, characterized in that it comprises the sequence CKNRLIC or in particular the sequence RLLALETFIQNWWLLNLWGCKNRLIC or a variant of that sequence such as the sequence RLWALETLIQNQQRLNLWGCKGKLIC, the sequence RLLALETLLQNQQLLSLWGCKGKLVC, the sequence RARLLALETFIQNQQLLNLWGCKNRLICYTSVKWNKT, the sequence CERPGNQKIMAGPMAWYS MALSNTKGDTRAAYC or the sequence GPMAWY.

5. Synthetic peptide, characterized in that it is a protein fragment according to one of claims 1 to 4, in that it is obtained from the sequence SEQ ID No. 6 or from the sequence SEQ ID No. 7 and in that it is recognized by antibodies induced against an HIV-$1_{(VAU)}$ retrovirus or variant of this fragment capable of being recognized by antibodies induced by an HIV-$1_{(VAU)}$ retrovirus.

6. Protein, polypeptide or peptide according to claim 1, characterized in that said protein is a protein of the HIV-1 group (or subgroup) $O_{(DUR)}$ virus, deposited on 23 February 1995 at the CNCM under the reference I-1542 or a natural or synthetic peptide or polypeptide comprising at least a part of said protein or a peptide whose sequence is distinguished from that of the above by substitution, deletion or addition of amino acids, this separate peptide nevertheless retaining the antigenic characteristics of the above one.

7. Peptide according to claim 6, containing at least 4 consecutive amino acids whose entire consecutive amino acid sequence is contained in the GAG sequence represented in Figure 8 or in an immunologically similar GAG sequence obtained from a variant of the HIV-1 group (or subgroup) O DUR virus, said

immunologically similar sequence being recognized by antibodies which also specifically recognize at least one of the sequences AHPQQA, LWTTRAGNP contained in the GAG sequence of Figure 8.

8. Peptide according to claim 7, characterized in that it consists of a peptide whose amino acid sequence is contained either in one of the following sequences:

SPRTLNAWVKAVEEKAFNPEIIPMFMALSEGA (1)

MLNAIGGHQGALQVLKEVIN (2)

GPLPPGQIREPTGSDIAGTTSTQQEQI (3)

IPVGDIYRKWIVLGLNKMVKMYSPVSILDI (4)

QGPKEPFRDYVDRFYKTKLAE (5)

AHPQQA (5a)

LWTTRAGNP (5b)

or in the corresponding immunologically similar sequence, this peptide containing at least 4 consecutive amino acids of one of said sequences.

9. Peptide according to claim 8, characterized in that it consists of a peptide whose amino acid sequence is contained either in one of the following sequences:

SPRTLNAWVK (6)

GSDIAGTTST (7)

QGPKEPFRDYVDRF (8)

or in the corresponding immunologically similar sequence, this peptide containing at least four consecutive amino acids of one of said sequences.

10. Peptide according to claim 8, characterized in that it contains the following amino acid sequence:

NPEI (9).

11. Peptide according to claim 8, characterized in that it contains the following amino acid sequence:

AVEEKAFNPEIIPMFM (10).

12. Peptide according to claim 6, containing at least 4 consecutive amino acids, whose entire sequence is contained in the sequence of the region of the V3 loop of gp120 represented in Figure 9 or in the corresponding immunologically similar sequence,

obtained from a variant of the HIV-1 group (or subgroup) O DUR virus, said immunologically similar sequence being recognized by antibodies which also specifically recognize at least one of the sequences:

KEIKI (12),

EREGKGAN (13),

CVRPGNNSVKEIKI (14),

QIEREGKGANSR (15).

13. Peptide according to claim 12, containing:

a) either the sequence CVRPGNNSVKEIKIGPMAWYSMQIEREGKGANSRTAFC (11) or a part of this sequence which contains at least 4 amino acids

b) or an amino acid sequence which is separate from the sequence of a) in which one or more amino acids are replaced with two amino acids, with the proviso that the peptide retains its reactivity with an antiserum against the above said peptide,

c) or an amino acid sequence which is separate from a) or b), in which one or more amino acids have been deleted or added, with the proviso that the peptide retains its reactivity with an antiserum against the peptide of a),

d) or the corresponding immunologically similar sequence or part of sequence.

14. Peptide according to claim 13, which contains the sequence KEIKI (12).

15. Peptide according to claim 13, which contains the sequence EREGKGAN (13).

16. Peptide according to claim 13 or 14, which contains either the amino acid sequence CVRPGNNSVKEIKI (14) or the sequence QIEREGKGANSR (15).

17. Peptide according to claim 13, which comprises the sequence GPMAWYSM (16).

18. Peptide according to claim 6, containing at least 4 consecutive amino acids, whose entire sequence is contained in the sequence of the immunodominant region of gp41 represented in Figure 9 or in the

corresponding immunologically similar sequence, obtained from a variant of the HIV-1 group (or subgroup) O DUR virus, said immunologically similar sequence being recognized by antibodies which also specifically recognize at least one of the sequences:

RLLALETLMQNQQL (17),

LNLWGCRGKAICYTSVQWNETWG (18),

CRGKAI (19),

SVQWN (20),

RLLALETLMONQQLLNLWGCRGKAICYTS (21),

QNQQLLNLWGCRGKAICYTSVQWN (22).

19. Peptide according to claim 18, containing the sequence RLLALETLMQNQQL (17) LNLWGCRGKAICYTSVQWNETWG (18) or part of this peptide containing:

a) either the sequence CRGKAI (19) or the sequence SVQWN (20) in which Q is, where appropriate, replaced by a different amino acid, which is nevertheless also different from K, or the two sequences at the same time,

b) or an amino acid sequence which is separate from the sequence of a) in which one or more amino acids are replaced with two amino acids, with the proviso that the peptide retains its reactivity with an antiserum against the peptide of a),

c) or an amino acid sequence which is separate from a) or b), in which one or more amino acids have been deleted or added, with the proviso that the peptide retains its reactivity with an antiserum against the peptide of a),

d) or in the corresponding immunologically similar sequence or part of sequence.

20. Peptide according to claim 19, characterized in that its N-terminal sequence which contains at least 8 amino acids is not immunologically recognized by antibodies formed against the sequence RILAVERY contained in the immunodominant region of gp41 of the HIV-1-LAI strain.

21. Peptide according to claim 19, characterized in that it is not recognized by antibodies formed against the peptide SGKLIC of the HIV-1-LAI strain.

22. Peptide according to claim 19, characterized in that it contains one or the other of the following two sequences:

RLLALETLMONQQLLNLWGCRGKAICYTS (21)

QNQQLLNLWGCRGKAICYTSVQWN (22).

23. Nucleotide sequence, more particularly DNA and cloned DNA fragments which may be obtained from RNA, from cDNA or from primers which may be used for gene amplification, derived from the RNA or the DNA of the HIV-1 group (or subgroup) O retrovirus, said nucleotide sequence being characterized in that it comprises the sequence corresponding to one of the sequences Seq ID No. 5, Seq ID No. 9, Seq ID No. 10 or Seq ID No. 11, as well as any portion of this sequence, in particular the sequences coding for the proteins, polypeptides or peptides of any one of claims 8 to 22 or variant of this portion which is capable of hybridizing with the corresponding DNA or RNA of the HIV-1 group (or subgroup) O virus.

24. Nucleotide sequence according to claim 23, characterized in that it is DNA or DNA fragments obtained from RNA, from cDNA or from primers for gene amplification, derived from the RNA or the DNA of the $HIV\text{-}1_{(VAU)}$ or $HIV\text{-}1_{(DUR)}$ retrovirus, the sequence comprising the sequence corresponding to Seq ID No. 5 as well as any portion of this sequence or variant of this portion which is capable of hybridizing with the corresponding DNA or RNA of the $HIV\text{-}1_{(VAU)}$ virus, or the sequence comprising the sequence corresponding to Seq ID No. 9 or Seq ID No. 10 or Seq ID No. 11, as well as any portion of this sequence or variant of this portion which is capable of hybridizing with the corresponding DNA or RNA of the $HIV\text{-}1_{(DUR)}$ virus.

25. Nucleotide sequence according to claim 23 or claim 7, characterized in that said sequence is chosen from the group of sequences corresponding to Seq ID No. 1, Seq ID No. 2, Seq ID No. 3 and Seq ID No. 4.

26. Nucleotide sequence, characterized in that it comprises the sequence of nucleotides corresponding to SEQ ID No. 7 and in that it codes for the integrase of an HIV-1 group (or subgroup) O retrovirus, in particular of an HIV-$1_{(VAU)}$ retrovirus, or nucleotide sequence which hybridizes with the sequence containing the sequence SEQ ID No. 7.

27. Oligonucleotide comprising at least 9 nucleotides, as obtained from a nucleotide sequence according to any one of claims 23 to 26, which is capable of being used as a primer for the gene amplification of an HIV-1 group (or subgroup) O retrovirus.

28. Oligonucleotide according to claim 27, having a sequence consisting of at least nine consecutive nucleotides of the following nucleotide sequences:

ATT CCA ATA CAC TAT TGT GCT CCA-3'

AAA GAA TTC TCC ATG ACT GTT AAA-3'

GGT ATA GTG CAA CAG CAG GAC AAC-3'

AGA GGC CCA TTC ATC TAA CTC-3'

29. Oligonucleotide according to claim 28, characterized in that it may be used during a process of gene amplification of a nucleotide sequence coding for a peptide according to any one of claims 6 to 22.

30. Nucleotide sequence which may be used as a probe, characterized in that it hybridizes under highly stringent hybridization conditions with the DNA produced by gene amplification by means of primers according to any one of claims 27 to 29.

31. Composition for the detection of the presence or absence of an HIV-1 group (or subgroup) O retrovirus, in particular the HIV-$1_{(VAU)}$ and/or HIV-$1_{(DUR)}$ retrovirus, in samples of serum or of other biological liquids or tissue obtained from patients suspected of

being carriers of an HIV-1 group (or subgroup) O retrovirus, said composition being characterized in that it comprises at least one probe obtained from a nucleotide sequence derived from the genome of the $HIV\text{-}1_{(VAU)}$ virus, particularly an $HIV\text{-}1_{(VAU)}$ DNA fragment containing the *env* region or a part of the *env* region of the $HIV\text{-}1_{(VAU)}$ virus, of a variant of $HIV\text{-}1_{(VAU)}$ as defined in any one of claims 23 to 27, and/or a probe obtained from a nucleotide sequence derived from the genome of the $HIV\text{-}1_{(DUR)}$ virus, the $HIV\text{-}1_{(DUR)}$ DNA containing the env region or a part of the env region and a part of the GAG region of the $HIV\text{-}1_{(DUR)}$ virus as defined [lacuna] claim 23 or 24.

32. Composition according to claim 12, characterized in that said composition also comprises a probe obtained from a nucleotide sequence obtained from HIV-1 not belonging to the O subgroup and/or from HIV-2.

33. Composition for the detection of the presence or absence of an HIV-1 group (or subgroup) O retrovirus, in particular the $HIV\text{-}1_{(VAU)}$ retrovirus and/or the HIV-1 group (or subgroup) $O_{(DUR)}$ retrovirus in a biological sample, said composition being characterized in that it comprises at least two nucleotide sequences according to any one of claims 23 to 27, and at least two nucleotide sequences according to claim 23 or 24, which are respectively derived from the genome of the $HIV\text{-}1_{(VAU)}$ and $HIV\text{-}1_{(DUR)}$ viruses, which sequences can be used as primers for amplification, in particular by PCR, of the DNA and/or the RNA of HIV-1 retrovirus of the O subgroup and in particular of $HIV\text{-}1_{(VAU)}$ and $HIV\text{-}1_{(DUR)}$.

34. Nucleotide sequence, characterized in that it is an RNA sequence corresponding to a DNA sequence according to any one of claims 23 to 31.

35. Composition for the in vitro detection of the presence, in a human biological sample, of anti-HIV-$1_{(VAU)}$ and anti-HIV-$1_{(DUR)}$ antibodies, said composition comprising at least one antigen comprising a protein, a glycoprotein, a polypeptide or a peptide of the envelope protein of an HIV-$1_{(VAU)}$ retrovirus as defined in any one of claims 1 to 5 and/or of the sequence comprising the sequence corresponding to Seq ID No. 9 or Seq ID No. 10 or Seq ID No. 11, as well as any portion of this sequence or variant of this portion which is capable of hybridizing with the corresponding DNA or RNA of the HIV-$1_{(DUR)}$ virus.

36. Composition according to claim 35, characterized in that it also comprises an antigen such as a protein, a glycoprotein, a polypeptide or a peptide of an HIV-1 virus not belonging to the subgroup O and/or of an HIV-2 virus or a peptide derived from an HIV-1 virus not belonging to the subgroup O and/or of an HIV-2 virus having an epitope which may be recognized by the antibodies induced by the HIV-1 virus not belonging to the subgroup O and/or the HIV-2 virus.

37. Composition according to claim 36, characterized in that the proteins and/or glycoproteins of HIV-1 not belonging to the subgroup O and/or of HIV-2 are gag or pol proteins or peptides thereof.

38. Composition according to claim 37, characterized in that the proteins and/or glycoproteins of HIV-1 not belonging to the subgroup O and/or of HIV-2 are envelope glycoproteins.

39. Composition according to any one of claims 35 to 38, characterized in that said composition comprises a peptide sequence corresponding to the entire region 590-620 of the gp41 protein of HIV-$1_{(VAU)}$ or a part of this region which is specific for HIV-$1_{(VAU)}$.

40. Composition according to claim 20, characterized in that said peptide sequence is the sequence -TFIQN-, CKNRLIC or WGCKNR.

41. Antibody which may recognize a protein, a peptide or a polypeptide derived from said protein according to any one of claims 1 to 22.

42. Process for the <u>in vitro</u> diagnosis of an infection caused by the HIV-$1_{(VAU)}$ virus and/or by the HIV-$1_{(DUR)}$ virus, said process comprising:

- the placing in contact of a serum or of another biological medium, derived from a patient forming the subject of the diagnosis, with at least one of the envelope proteins or glycoproteins of the HIV-$1_{(VAU)}$ and/or HIV-$1_{(DUR)}$ virus or of a peptide or polypeptide obtained from one of these proteins or glycoproteins respectively according to any one of claims 1 to 5 and according to any one of claims 6 to 22, or a composition according to any one of claims 35 to 38, and
- the detection of an immunological reaction.

43. Reagent required for the Western blot (immunoblot) or ELISA reaction, containing an envelope protein or glycoprotein of the HIV-$1_{(VAU)}$ and/or HIV-$1_{(DUR)}$ virus or of a peptide or polypeptide obtained from one of these proteins or glycoproteins according to any one of claims 1 to 5 and according to any one of claims 6 to 22 or a composition according to any one of claims 35 to 38.

44. Use of a nucleotide sequence according to claim 23 or 24 in order to induce <u>in vivo</u> the synthesis of antibodies directed against the antigen coded for by said sequence.

45. Immunogenic composition according to any one of claims 35 to 38, which is capable of inducing antibodies in animals.

46. Diagnostic kit for the in vitro detection, on a biological sample, of an infection with an HIV-1 subgroup O retrovirus, for example of an $HIV\text{-}1_{(VAU)}$ and/or $HIV\text{-}1_{(DUR)}$ retrovirus, characterized in that it comprises:

- primers according to any one of claims 27 to 29 for the gene amplification of an HIV-1 subgroup O retrovirus,
- reagents required for the gene amplification reaction.

47. Kit for the in vitro detection, on a biological sample, of an HIV-1 subgroup O retrovirus, characterized in that it comprises as optionally labeled probe, at least one nucleotide sequence according to one of claims 23 to 29 and 34 or a composition according to one of claims 31, 32 or 33, and optionally another nucleotide probe according to any one of claims 23 to 29 or composition according to any one of claims 31, 32 or 33, which is optionally immobilized on a solid support.

48. Kit according to claim 28, characterized in that it also comprises the reagents required for carrying out a hybridization.

49. Process of detection and discrimination, in a biological sample, between antibodies characteristic of an HIV-1 group (or subgroup) O retrovirus and antibodies characteristic of an HIV-1 subgroup M retrovirus, characterized by the placing in contact of this biological sample with a peptide chosen from peptides (1), (2), (3), (4), (5a) and (5b) of claim 8, peptide (9) of claim 10 and peptide (10) of claim 11.

50. Process of detection and discrimination, in a biological sample, between antibodies characteristic of an HIV-1 group (or subgroup) O retrovirus and antibodies characteristic of an HIV-1 subgroup M retrovirus, characterized by the placing in contact of this biological sample with a peptide obtained from one

of the HIV-1 subgroup M viruses taken into consideration in Figures 8 and 9 and homologous with a peptide chosen from those of claim 49, the sequence of this homologous peptide resulting from vertical alignments of its own successive amino acids, which are themselves contained in the pertinent peptide sequence relative to the corresponding HIV-1 subgroup M virus and represented in Figure 8 or 9 with the successive amino acids of the chosen peptide sequence, as also follows from Figure 8 or 9.

51. Process of detection and discrimination between infection with an HIV-1 group (or subgroup) O retrovirus and of the HIV-1 subgroup M type, characterized by the placing in contact of sera, derived from individuals subjected to a diagnostic test for AIDS, with the peptide RILAVERY.

52. Process for the detection of infection due either to an HIV-1 group (or subgroup) O or HIV-1 subgroup M retrovirus, characterized by the use of mixtures of two categories of peptides, those of the first category corresponding to those identified in claim 49.

53. Process of discrimination between an infection due to an HIV-1 group (or subgroup) O DUR retrovirus or variant, and an infection due to another type of HIV-1 group (or subgroup) O retrovirus, characterized by the placing in contact of the biological sample studied with any one of the following peptides:

- peptide (11) of claim 38, peptide (12) of claim 39 or peptide (13) of claim 40,
- peptide (14) or peptide (15) of claim 41 or
- peptides (17), (18), (19) and (20) of claim 44.

54. Vector containing a nucleic acid whose nucleotide sequence corresponds to any one of the sequences of claims 23 to 30.

55. Vector according to claim 57, characterized in that it is a plasmid.

56. Plasmid chosen from those which were deposited at the CNCM on 24 February 1995 under the references I-1548, I-1549 and I-1550.

57. Cell containing a nucleic acid whose nucleotide sequence corresponds to any one of the sequences of claims 54 and 55.

58. Virus deposited on 23 February 1995 at the CNCM under the reference I-1542.

59. Virus of the same type or subtype as the virus of claim 58, characterized in that the consensus peptides of this virus are recognized by antibodies which specifically recognize a peptide according to any one of claims 6 to 22.

60. Kit for the <u>in vitro</u> detection of antibodies against HIV, containing at least one peptide according to any one of claims 6 to 22.

61. Kit according to claim 60, also containing at least one consensus peptide derived from another HIV strain comprising:

either an amino acid sequence which is separate from the sequence of this peptide, in which one or more amino acids are replaced with other amino acids, with the proviso that the peptide retains its reactivity with an antiserum against the consensus peptide,

or an amino acid sequence in which one or more amino acids have been deleted or added, with the proviso that the peptide or polypeptide retains its reactivity with an antiserum against the consensus peptide.

62. Kit according to claim 60 or 61, characterized in that the other HIV strain is an HIV-LAI strain.

63. Process of discrimination between an infection with an HIV-1 group (or subgroup) O retrovirus and an HIV-1 subgroup M retrovirus, using a serine protease whose cleaving action is carried out on an SR

dipeptide, and comprising the detection of a cleavage or of a on-cleavage of the V3 loop of gp120 of the retrovirus, depending on whether this retrovirus is an HIV-1 group (or subgroup) O retrovirus or an HIV-1 subgroup M retrovirus.

64. Viral lysate as obtained by lysis of cells infected with a virus according to claim 58 or 59 or with an HIV-$1_{(VAU)}$ virus.

65. Protein extract of HIV-1 $O_{(DUR)}$ strain containing in particular an antigenic peptide according to any one of claims 6 to 22, or of HIV-1 group (or subgroup) $O_{(VAU)}$ strain containing in particular an antigenic peptide according to any one of claims 1 to 5.

66. Bacterial strain deposited at the CNCM on 20 October 1994 under the access number I-1486.

67. Composition for detection and discrimination, in a biological sample, between an HIV-1 subgroup M retrovirus and an HIV-1 group (or subgroup) O retrovirus, comprising a mixture of two categories of peptides, the first being those identified in claim 49.

68. Peptide according to claim 8, characterized in that it consists of a peptide whose amino acid sequence is contained either in one of the following sequences:

IGGHQGALQ (23)

REPTGSDI (24)

or in a corresponding immunologically similar sequence, this peptide containing at least 4 consecutive amino acids of one of said sequences.

69. Peptide according to claim 7, characterized in that it consists of a peptide whose amino acid sequence is contained in the following amino acid sequence:

INDEAADWD (25)

or in a corresponding immunologically similar sequence, this peptide containing at least 4 consecutive amino acids of said sequence.

70. Nucleic acid coding for the peptides of claims 68 and 69.

71. Composition comprising at least one nucleic acid according to claim 70.

72. Use of at least one nucleic acid according to claims 70 and 71 for detection and discrimination between HIV-1 group M and HIV-1 group O strains.